

Claims

1. A cell structure for identification of substances in flowing sample gas, based on ion mobility, **characterised** in that the cell structure (200A, 300) has a flow channel (200) for controlling the gas flow, a reference cell (201, 411) arranged to form a reference signal, a ionisation section (202, 410) for achieving an ionisation effect into the sample gas, and an analysis cell (203, 409) arranged to form an analysis signal so that the reference cell (201, 411), the ionisation section (202, 410), and the analysis cell (203, 409) are located in said order in the direction of the flow of the sample gas in the flow channel (200).
- 10 2. A cell structure (300) according to claim 1, characterised in that it also has a front cell (414) before the reference cell (411), and/or a back cell (415) after the analysis cell (409), in the gas flow direction.
3. A cell structure (200A, 300) according to claim 1, **characterised** in that it has a reference cell (201, 411) with an electrode structure that is substantially similar to the electrode structure in the analysis cell (203, 409).
- 15 4. A cell structure (200A, 300) according to claim 1, **characterised** in that it has in a cell an electrode pair with the first electrode (303, 313, 323, 333) and the second electrode (304, 314, 324, 334).
5. A cell structure (200A, 300) according to claim 4, **characterised** in that at least one electrode (303, 313, 323, 333, 304, 314, 324, 334) is bipartite so that it has a first electrode part and a second electrode part.
- 20 6. A cell structure according to claim 5, **characterised** in that said first electrode part is arranged to provide such a first electric field that has a repeated peak value, direction and/or frequency.
- 25 7. A cell structure according to claim 6, **characterised** in that, that a second electrode part is arranged to provide such a second electric field that is different from said first electric field.
8. A cell structure (300) according to claim 1, **characterised** in that it has a divider plate in the flow channel for dividing the flow channel (200) in to two parts parallel with it (200), the parts being a first part (341) and a second part (342).
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9. A cell structure (300) according to claim 8, **characterised** in that the ionisation section is in the first part (341) of the flow channel for limiting the ionisation effect into a volume part in said part (341) of the flow channel.
10. A cell structure (300) according to claim 8, **characterised** in that, there is a
5 part (343) of a divider plate between a first electrode (303, 313, 323, 333) and a second electrode (304, 314, 324, 334).
11. A gas measuring device (400) for identifying substances in flowing gas, based on ion mobility, **characterised** in that it (400) has a cell structure (200A, 300) comprising a flow channel (200) for controlling a gas flow, a reference cell (201, 411)
10 arranged to form a reference signal, a ionisation section (201, 410) for achieving the ionisation effect into the sample gas, and an analysis cell (203, 409) arranged to form an analysis signal so that the reference cell (201, 411), the ionisation section (202, 410), and the analysis cell (203, 409) are located in said order in the direction of flow of the sample gas in the flow channel (200).
12. A gas measuring device (400) according to claim 11, **characterised** in that it
15 has signal processing means (407, 412, 422) for generating and/or forming a third signal on the basis of said reference signal and analysis signal.
13. A gas measuring device (400) according to claim 12, **characterised** in that the
20 reference cell and/or analysis cell has means for determining a property of the carrier gas so that said property of the carrier gas is at least one of the following:
- (a) a local dose rate, received into a certain volume of gas, caused by a radiation field originating to a radio nuclide;
 - (b) gas humidity;
 - (c) gas temperature;
 - 25 (d) gas composition;
 - (e) gas viscosity;
 - (f) gas density;
 - (g) mass-absorption coefficient of the gas for radiation.
14. A gas measuring device (400) according to claim 12, **characterised** in that it
30 has, for determination of the gas flow (100), such a cell structure (300) comprising a back field electrode pair and in such a first back field electrode (333) and a second back field electrode (334).
15. A gas measuring device (400) according to claim 12, **characterised** in that it has, for collecting ions and/or particles from the gas flow, a cell structure (300)

comprising a front field electrode pair and in such, a first front field electrode (323) and a second front field electrode (324).

16. A gas measuring device (400) according to claim 11, **characterised** in that it has transmitter-receiver means (404) for maintaining and controlling the functions
5 of the device (400) by remote control.

17. A gas measuring device (400) according to claim 16, **characterised** in that said transmitter-receiver means (404) are arranged to receive a impulse for controlling a part (409, 410, 411, 414, 415) of the gas measuring device (400).

18. A gas measuring device (400) according to claim 16, **characterised** in that
10 said transmitter-receiver means (404) are arranged to communicate a certain analysis result, status data and/or control value between the gas measuring device (400) and a device (401) arranged to be communicating with the gas measuring device.

19. A gas measuring device (400) according to claim 11, **characterised** in that it has a microprocessor (406) for maintaining and/or controlling the functions of the
15 gas measuring device (400).

20. A method for an identification of substances in flowing gas, based on electrical mobility of ions, **characterised** in that it has the following steps, in which
(a) a first electric field is set (500A) between electrodes in a reference electrode pair;
20 (b) a second electric field is set (500B) between electrodes in an analysis electrode pair;
(c) a gas sample is taken (501) to be transported through the reference electrode pair, a ionisation section and the analysis electrode pair in said order;
(d) the gas sample is analysed (503);
25 (e) a mobility spectrum of ions is formed (504); and
(f) an ion is identified from the gas sample on the basis of the mobility spectrum (505).

21. A method according to claim 20, **characterised** in that the step (d) has sub-steps, in which changes of charge on the electrodes in the reference electrode pair
30 are observed for forming a reference signal, sample gas is charged for generating ions, and the changes of charge on the electrodes in the analysis electrode pair are observed for forming an analysis signal.

22. A method according to claim 20 or 21, **characterised** in that in step (e), the mobility spectrum is formed on the basis of the reference signal and the analysis signal.
23. A method according to claim 20, **characterised** in that it has a step, in which
5 the gas sample is pre-processed (502) for removing particulate solid and/or liquid material before the sample arrives at the reference electrode pair.
24. A method according to claim 20, **characterised** in that in step (f), the identification is based on a mobility library or a respective database.
25. A system for an identification of substances in ion form from flowing gas, on
10 the basis of their electric mobility, **characterised** in that the system has a gas measuring device (400) comprising a cell structure (200A, 300) with a flow channel (200) for controlling a gas flow, a reference cell (201, 411) arranged for forming a reference signal, an ionisation section (201, 411) arranged to achieve an ionisation effect to a sample gas, and an analysis cell (203, 409) arranged for forming an
15 analysis signal so that the reference cell (201, 411), the ionisation section (202, 410), and the analysis cell (203, 409) are located in said order in the direction of flow of the sample in the flow channel (200), and that the system further comprises a transmitter-receiver means (404) for transmitting data between the gas measuring device (400) and a radio terminal device (401).
- 20 26. A system according to claim 25, **characterised** in that said cell structure further comprises a front cell (414) and/or a back cell (415).
27. A method for electrically determining the gas flow velocity in an aspiration condenser, **characterised** in that the method comprises the steps, in which
25 (a1) a first electric field is set between electrodes in a first electrode pair comprising a first electrode;
(a2) a second electric field is set between electrodes in a second electrode pair, comprising a second electrode;
(a3) a third electric field is set between electrodes in a third electrode pair comprising a third electrode;
30 (a4) changes of charge of the first, second and third electrode in said first, second and third electric field are observed;
(a5) changes of charge detected, with the help of said second and third electrode, are corrected on the basis of the changes of charge detected on the first electrode;

(a6) time is determined, which passes between the occurrence of certain changes of charge on the second electrode and the occurrence on the third electrode;

(a7) the gas velocity is calculated.

28. A method according to claim 27 for determining gas flow velocity, **character-**
5 **ised** in that in step (a6) an autocorrelation function is formed for determining the time between the detected changes of charge on the second and third electrode.